

(26) *Polarization mode dispersion* means, for a particular length of fiber, the average of the differential group delays of the two polarized components of light pulses traveling in the fiber, when the light pulses are generated from a sufficient narrow band source. The differential group delay varies randomly with time and wavelength. The term PMD is used in the industry in the general sense to indicate the phenomenon of birefringence (polarized light having different group velocities), and used specifically to refer to the value of time delay expected in a specific length of fiber.

(27) *PMD_Q* means the statistical upper bound for the PMD coefficient of a fiber optic cable link composed of M number of randomly chosen concatenated fiber optic cable sections of the same length. The upper bound is defined in terms of a probability level Q, which is the probability that a concatenated PMD coefficient value exceeds PMD_Q. ITU G recommendations for fiber optic cables call for M = 20 and Q = 0.01%. This PMD_Q value is the one used in the design of fiber optic links.

(28) *Ribbon* means a planar array of parallel optical fibers.

(29) *Shield* means a conductive metal tape placed under the cable jacket to provide lightning protection, bonding, grounding, and electrical shielding.

(30) *Single mode fiber* means an optical fiber in which only one bound mode of light can propagate at the wavelength of interest.

(31) *Step Refractive Index Profile* means an index profile characterized by a uniform refractive index within the core, a sharp decrease in refractive index at the core-cladding interface, and a uniform refractive index within the cladding.

(32) *Tight tube buffer* means one or more layers of buffer material tightly surrounding a fiber that is in contact with the coating of the fiber.

[74 FR 20561, May 5, 2009]

§ 1755.901 Incorporation by Reference.

(a) *Incorporation by reference.* The materials listed here are incorporated by reference where noted. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C.

552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval, and notice of any change in these materials will be published in the FEDERAL REGISTER. The materials are available for purchase at the corresponding addresses noted below. All are available for inspection at the Rural Development Utilities Programs, during normal business hours at room 2849-S, U.S. Department of Agriculture, Washington, DC 20250. Telephone (202) 720-0699, and e-mail norberto.esteves@wdc.usda.gov. The materials are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of these materials at NARA, call (202) 741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

(b) The American National Standards Institute/Institute of Electrical and Electronics Engineers, Inc. ANSI/IEEE C2-2007, *The National Electrical Safety Code*, 2007 edition, approved April 20, 2006, (“ANSI/IEEE C2-2007”), incorporation by reference approved for § 1755.902(a), § 1755.902(p), § 1755.903(a), § 1755.903(k) and § 1755.903(n). ANSI/IEEE C2-2007 is available for purchase from IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, telephone 1-800-678-4333 or online at <http://standards.ieee.org/nesc/index.html>.

(c) The following Insulated Cable Engineers Association standards are available for purchase from the Insulated Cable Engineers, Inc. (ICEA), P.O. Box 1568, Carrollton, GA 30112 or from Global Engineering Documents, 15 Iverness Way East, Englewood, CO 80112, telephone 1-800-854-7179 (USA and Canada) or 303-792-2181 (International), or online at <http://global.ihs.com>:

(1) ICEA S-110-717-2003, *Standard for Optical Drop Cable*, 1st edition, September 2003 (“ICEA S-110-717”), incorporation by reference approved for § 1755.903(a), § 1755.903(b), § 1755.903(c), § 1755.903(d), § 1755.903(e), § 1755.903(f), § 1755.903(g), § 1755.903(l), § 1755.903(n), § 1755.903(p), § 1755.903(u); and

(2) ANSI/ICEA S-87-640-2006, *Standard for Optical Fiber Outside Plant Communications Cable*, 4th edition, December

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2006 (“ANSI/ICEA S-87-640”), incorporation by reference approved for § 1755.902(a), § 1755.902(b), § 1755.902(c), § 1755.902(d), § 1755.902(e), § 1755.902(i), § 1755.902(l), § 1755.902(m), § 1755.902(n), § 1755.902(p), § 1755.902(q), § 1755.902(r), § 1755.902(u), § 1755.903(b), § 1755.903(g), § 1755.903(l), § 1755.903(o), § 1755.903(p), and § 1755.903(s).

(d) The following American Society for Testing and Materials (ASTM) standards are available for purchase from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. Telephone (610) 832-9585, Fax (610) 832-9555, by e-mail at service@astm.org, or online at <http://www.astm.org> or from ANSI, 1916 Race Street, Philadelphia, PA 19103, telephone (215) 299-5585, or online at <http://webstore.ansi.org/ansidocstore/default.asp>:

(1) ASTM A 640-97, (Reapproved 2002)^{e1}, *Standard Specification for Zinc-Coated Steel Strand for Messenger Support of Figure 8 Cable*, approved September 2002 (“ASTM A 640”), incorporation by reference approved for § 1755.902(n);

(2) ASTM B 736-00, *Standard Specification for Aluminum, Aluminum Alloy and Aluminum-Clad Steel Cable Shielding Stock*, approved May 10, 2000 (“ASTM B 736”), incorporation by reference approved for § 1755.902(m) and § 1755.903(j);

(3) ASTM D 4565-99, *Standard Test Methods for Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable*, approved March 10, 1999 (“ASTM D 4565”), incorporation by reference approved for § 1755.902(c), § 1755.902(m), § 1755.903(c) and § 1755.903(j);

(4) ASTM D 4566-98, *Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable*, approved December 10, 1998 (“ASTM D 4566”), incorporation by reference approved for § 1755.902(f), § 1755.902(t) and § 1755.903(t); and

(5) ASTM D 4568-99, *Standard Test Methods for Evaluating Compatibility Between Cable Filling and Flooding Compounds and Polyolefin Wire and Cable Materials*, approved April 10, 1999 (“ASTM D 4568”), incorporation by reference approved for § 1755.902(h).

(e) The following Telecommunications Industry Association/Electronics Industries Association (TIA/EIA) standards are available from Electronic Industries Association, Engineering Department, 1722 Eye Street, NW., Washington, DC 20006; or from Global Engineering Documents, 15 Iverness Way East, Englewood, CO 80112, telephone 1-800-854-7179 (USA and Canada) or (303) 792-2181 (International), or online at <http://global.ihs.com>; or from TIA, 2500 Wilson Blvd, Suite 300, Arlington, VA 22201, telephone 1-800-854-7179 or online <http://www.tiaonline.org/standards/catalog>:

(1) TIA/EIA Standard 455-3A, *FOTP-3, Procedure to Measure Temperature Cycling on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components*, approved May 1989, (“TIA/EIA Standard 455-3A”), incorporation by reference approved for § 1755.902(r).

(2) [Reserved]

(f) The following International Telecommunication Union (ITU) recommendations may be obtained from ITU, Place des Nations, 1211 Geneva 20, Switzerland, telephone +41 22 730 6141 or online at <http://www.itu.int/ITU-T/publications/recs.html>:

(1) ITU-T Recommendation G.652, *Series G: Transmission Systems and Media, Digital Systems and Networks, Transmission media characteristics—Optical fibre cables, Characteristics of a single-mode optical fibre and cable*, approved June 2005 (“ITU-T Recommendation G.652”), incorporation by reference approved for § 1755.902(b), § 1755.902(q), § 1755.903(b) and § 1755.903(o);

(2) ITU-T Recommendation G.655, *Series G: Transmission Systems and Media, Digital Systems and Networks, Transmission media characteristics—Optical fibre cables, Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable*, approved March 2006 (“ITU-T Recommendation G.655”), incorporation by reference approved for § 1755.902(b) and § 1755.902(q);

(3) ITU-T Recommendation G.656, *Series G: Transmission Systems and Media, Digital Systems and Networks, Transmission media characteristics—Optical fibre cables, Characteristics of a fibre and cable with non-zero dispersion for wide-band optical transport*, approved December 2006 (“ITU-T Recommendation

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G.656”), incorporation by reference approved for § 1755.902(b) and § 1755.902(q);

(4) ITU–T Recommendation G.657, *Series G: Transmission Systems and Media, Digital Systems and Networks, Transmission media characteristics—Optical fibre cables, Characteristics of a bending loss insensitive single mode optical fibre and cable for the access network*, approved December 2006 (“ITU–T Recommendation G.657”), incorporation by reference approved for § 1755.902(b) and § 1755.902(q); and

(5) ITU–T Recommendation L.58, *Series L: Construction, Installation and Protection of Cables and Other Elements of Outside Plant, Optical fibre cables: Special Needs for Access Network*, approved March 2004 (“ITU–T Recommendation L.58”), incorporation by reference approved for § 1755.902(a).

[74 FR 20561, May 5, 2009]

§ 1755.902 Minimum performance Specification for fiber optic cables.

(a) *Scope.* This section is intended for cable manufacturers, Agency borrowers, and consulting engineers. It covers the requirements for fiber optic cables intended for aerial installation either by attachment to a support strand or by an integrated self-supporting arrangement, for underground application by placement in a duct, or for buried installations by trenching, direct plowing, and directional or pneumatic boring.

(1) *General.* (i) Specification requirements are given in SI units which are the controlling units in this part. Approximate English equivalent of units are given for information purposes only.

(ii) The optical waveguides are glass fibers having directly-applied protective coatings, and are called “fibers,” herein. These fibers may be assembled in either loose fiber bundles with a protective core tube, encased in several protective buffer tubes, in tight buffer tubes, or ribbon bundles with a protective core tube.

(iii) Fillers, strength members, core wraps, and bedding tapes may complete the cable core.

(iv) The core or buffer tubes containing the fibers and the interstices between the buffer tubes, fillers, and strength members in the core structure

are filled with a suitable material or water swellable elements to exclude water.

(v) The cable structure is completed by an extruded overall plastic jacket. A shield or armor or combination thereof may be included under the jacket. The jacket may have strength members embedded in it, in some designs.

(vi) Buried installation requires armor under the outer jacket.

(vii) For self-supporting cable, the outer jacket may be extruded over the support messenger and cable core.

(viii) Cables for mid-span applications for network access must be designed for easy mid-span access to the fibers. The manufacturer may use reversing oscillating stranding (SZ) described in section 6.4 of ITU–T Recommendation L.58, *Construction, Installation and Protection of Cables and Other Elements of Outside Plant*, 2004 (incorporated by reference at § 1755.901(f)). The cable end user is cautioned that installed cable must be properly terminated. This includes properly securing rigid strength members (*i.e.*, central strength member) and clamping the cable and jacket. It is important that cable components be secured to prevent movement of the cable or components over the operating conditions. Central strength member (CSM) clamps must prevent movement of the CSM; positive stop CSM clamps are recommended. The CSM must be routed as straight and as short as practical to prevent bowing or breaking of the CSM. The cable and jacket retention must be sufficient to prevent jacket slippage over the operating temperature range.

(2) The normal temperature ranges for cables must meet paragraph 1.1.3 of ANSI/ICEA S–87–640, *Standard for Optical Fiber Outside Plant Communications Cable* (incorporated by reference at § 1755.901(c)).

(3) *Tensile rating.* The standard installation tensile rating for cables is 2670 N (600 lbf), unless installation involves micro type cables that utilize less stress related methods of installation, *i.e.*, blown micro-fiber cable or All-Dielectric Self-Supporting (ADSS) cables (see paragraph (c)(4) of this section).

(4) *ADSS and other self-supporting cables.* Based on the storm loading districts referenced in Section 25, Loading